# July 2004 NC Weather Review

## Overview

Numerous thunderstorms in July brought bountiful rainfall to much of western and northern North Carolina, continuing the wet trend that began in June. Most reporting stations across the state received between 4 and 7 inches of rain. These totals were either near normal or above normal. The greatest monthly rainfall amounts, 6 to 8 inches, fell over the western and northern portions of the state from the Mountains east across the Foothills, Piedmont, northern Coastal Plain, northern Coastal Area, and the northern Outer Banks. The largest rainfall totals occurred at Oxford, located in the northern Piedmont (8.79 inches), Robbinsville, located in the southwest Mountains (8.72 inches); and Raleigh, in the northeast Piedmont (8.16 inches).

Drier than normal conditions were limited to portions of southern and eastern North Carolina where rainfall totals of between 2.25 and 4 inches were recorded. These values were only half of normal. Tarboro, located in the Coastal Plain, was the driest spot, tallying only 2.35 inches. Mocksville, located in the western Piedmont, received only 2.86 inches. Figure 1 depicts selected precipitation reports versus normal for July 2004.

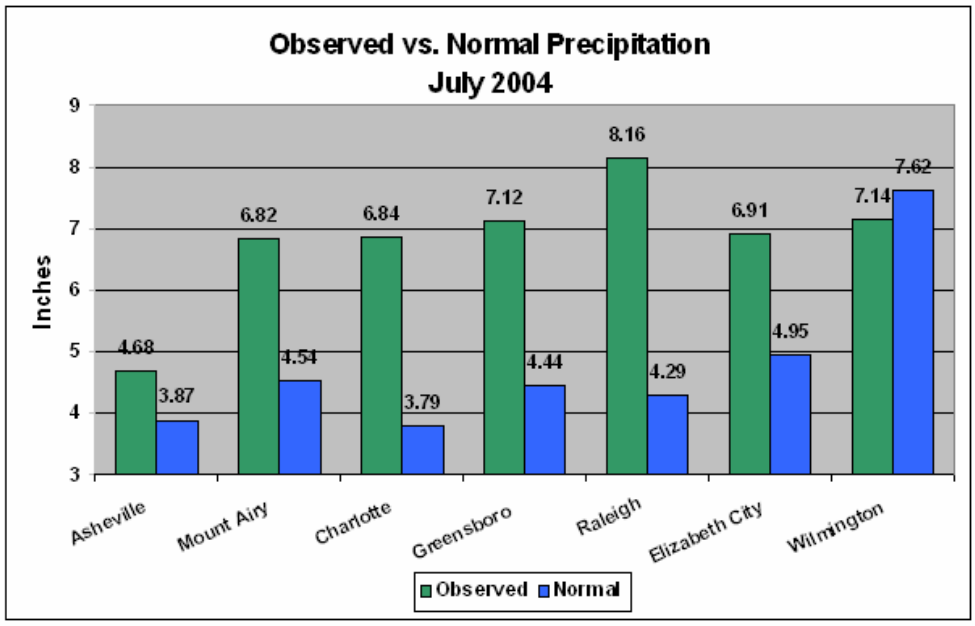


**Figure 1 Monthly precipitation reports vs. normal rainfall for July 2004 at selected locations across North Carolina.**

Temperatures during July 2004 averaged slightly above normal in the eastern sections, while the western part of the state averaged slightly below normal. The Outer Banks were an exception with monthly temperatures averaging around 1.5° above normal. There was only one prolonged period of hot weather during July. It occurred from the 4th through the 15th when daily highs frequently reached the 90s with little thunderstorm activity. The last two weeks of the month featured scattered to occasionally numerous thunderstorms that brought clouds, significant rains, and cooler daytime temperatures to North Carolina.

Figures 2 and 3 highlight the daily temperatures at both Raleigh-Durham and Greensboro. Note that the hottest weather occurred during the first two weeks of the month.

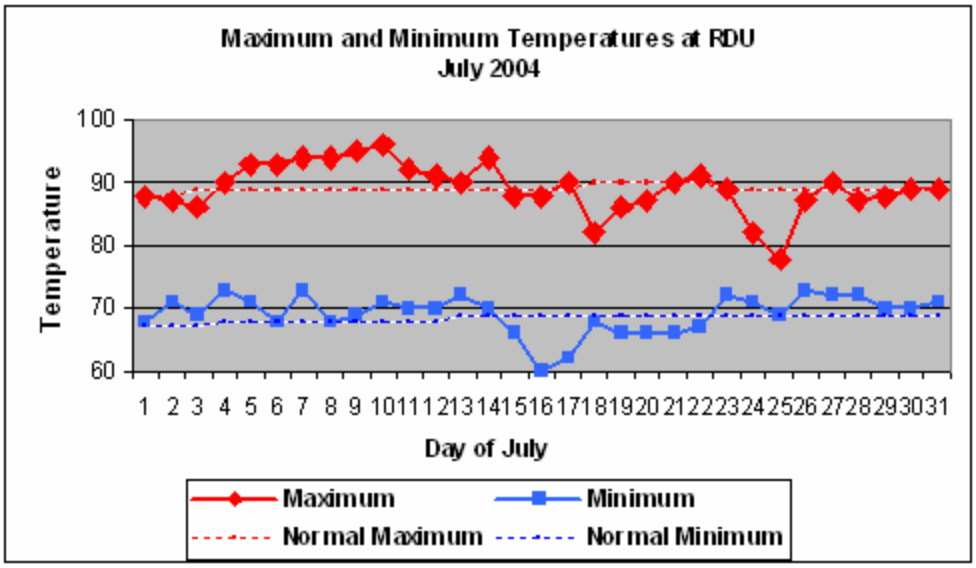


**Figure 2 Daily maximum and minimum temperatures observed in July 2004 at Raleigh-Durham (RDU).**

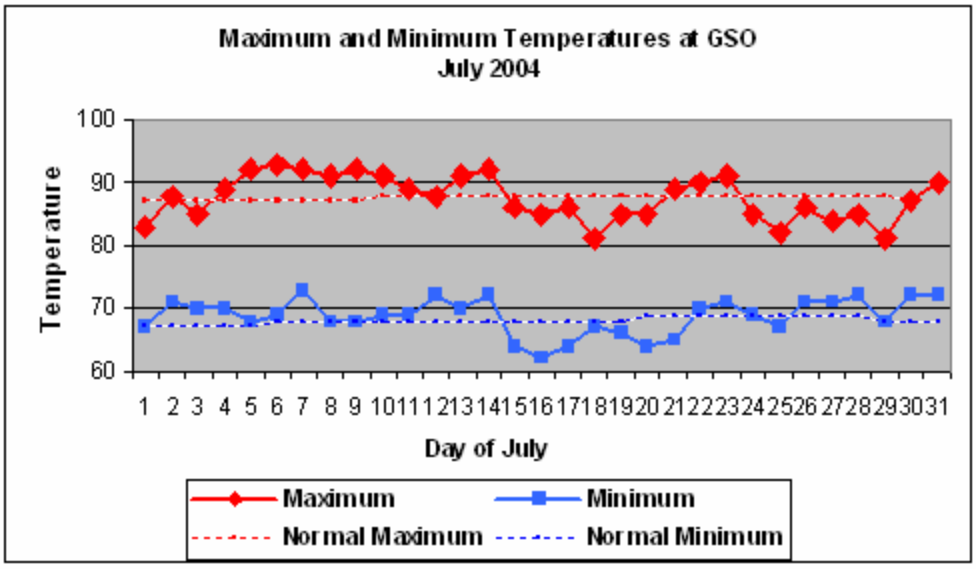


**Figure 3 Daily maximum and minimum temperatures observed in July 2004 at Greensboro (GSO).**

# Details

## Temperatures

A hot spell during the first two weeks of the month can be attributed to an upper level ridge of high pressure that developed over the Gulf Coast states around July 4. This pattern persisted for the first half of the month. The corresponding surface charts during this period often featured a westward extension of the Bermuda high pressure system.

A common pattern in the summer months across North Carolina is one that is dominated by a high pressure system located near Bermuda. This high pressure system is commonly known as the Bermuda high. The circulation around the Bermuda high brings a warm and moist southwesterly flow into North Carolina. However, there are variations in the Bermuda high weather pattern. One of the most typical variations is when the Bermuda high extends from the Atlantic Ocean westward across the Gulf Coast states, commonly referred to as the westward extension of the Bermuda high. It is one that typically brings North Carolina hot and dry weather.

Figure 4 is a surface map analyzed during the afternoon of July 5, 2004. This map indicates the westward extension of the Bermuda high from the Atlantic into Alabama and Tennessee. A hot and dry westerly flow often prevails over North Carolina with such patterns effectively shutting down any wind flow from the main moisture sources, the Gulf of Mexico and the Atlantic Ocean.

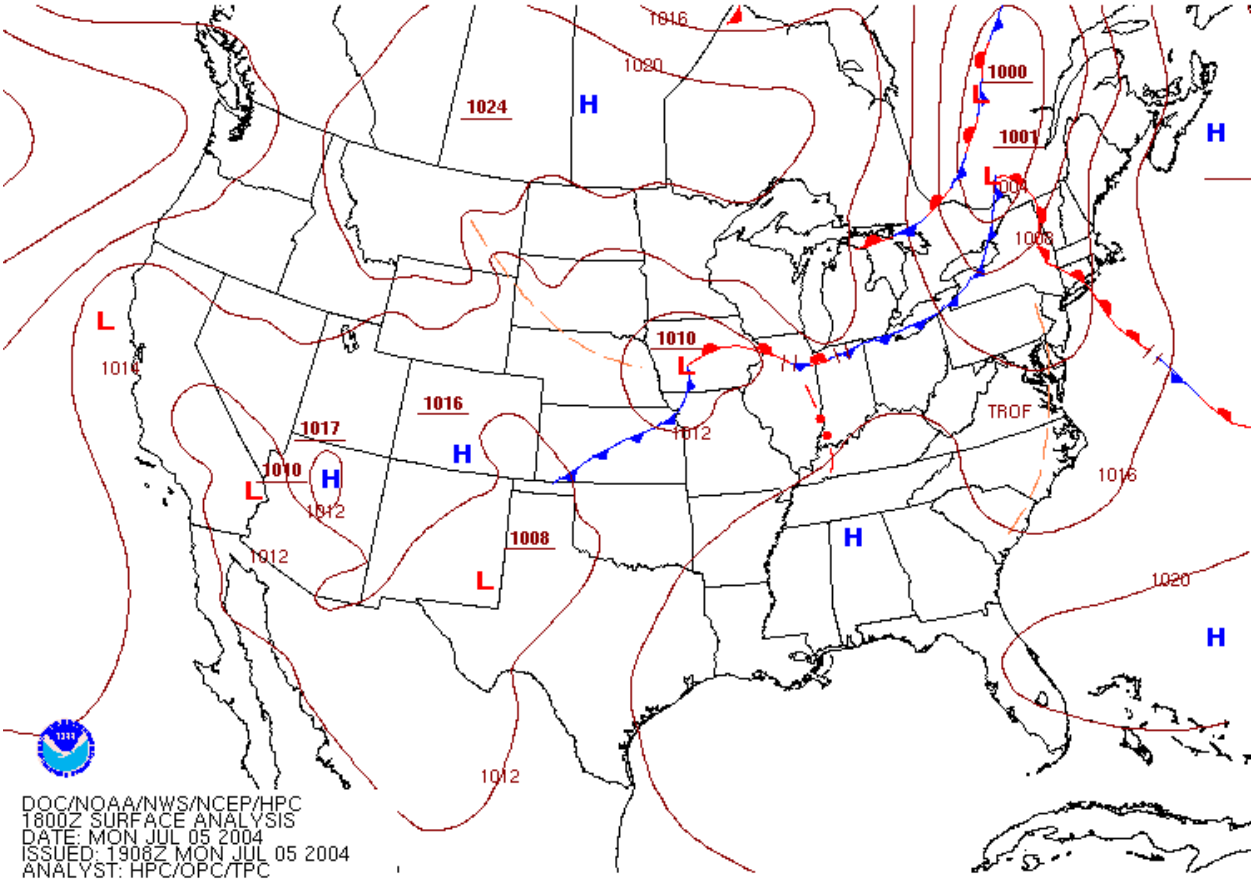


**Figure 4 Analyzed surface map 18Z (200 PM EDT) July 05, 2004**

The westward extension of the Bermuda high was a recurring theme during the early to mid portion of July 2004, producing the hottest and driest weather at many locations. Temperatures frequently exceeded 90° east of the mountains between July 4 and July 15. Some selected stations and their hottest temperatures recorded during the month of July 2004 include: Fayetteville, 99° (10th); Lumberton, 98° (7th); Wilmington, 97° (7th); Raleigh-Durham, 96° (10th); Charlotte, 94° (10th); Mount Airy, 91° (6th); and Asheville, 88° (14th). Surprisingly, there were no record daily highs observed.

The ridge of high pressure shifted back to its more typical position near Bermuda during the last two weeks of July. This allowed a moisture laden, southerly flow from off the Atlantic and Gulf of Mexico to replace the previously dry westerly flow. As a result, there was an increase in moisture, clouds and thunderstorm activity and lower temperatures. Figure 5 is an analyzed upper air chart from 800 PM EDT, July 28, 2004. Note the ridge of high pressure offshore in the Atlantic and the upper level trough over the Ohio River Valley. This pattern became fairly common over the eastern United States during the last two weeks of July 2004.

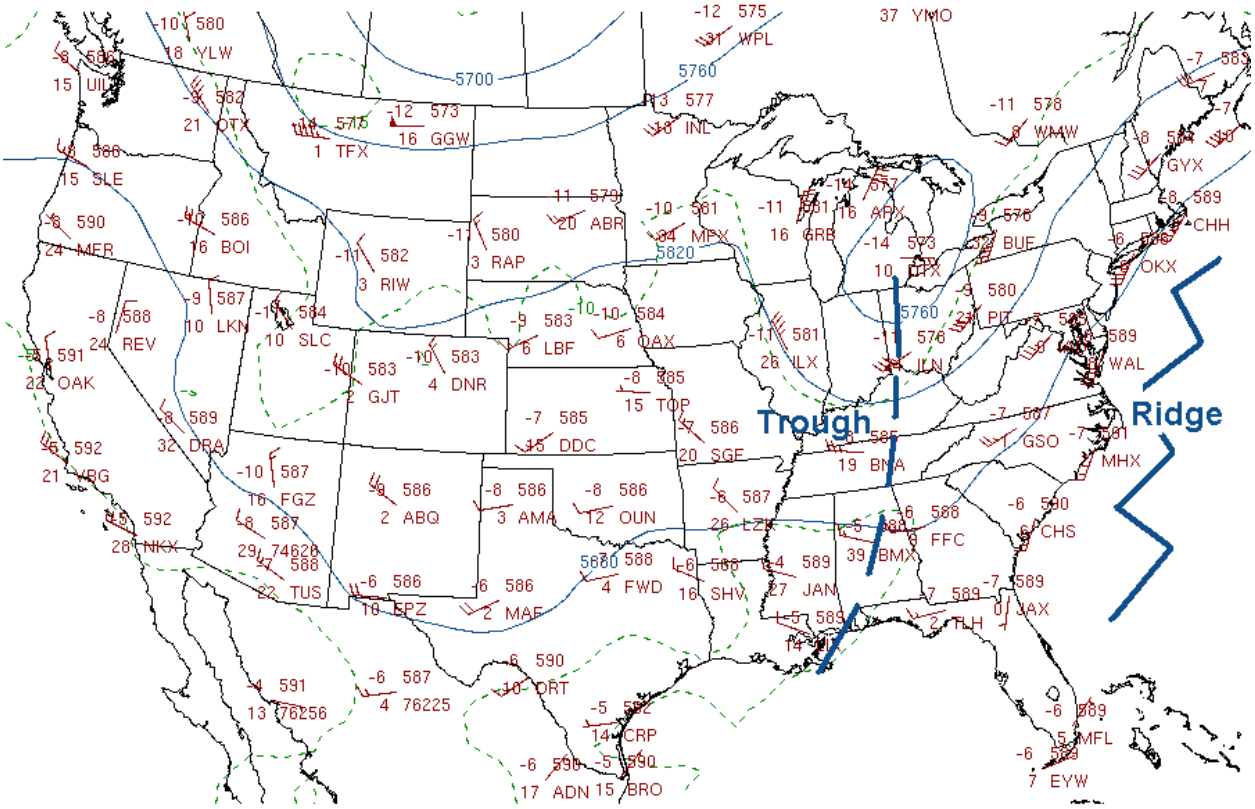


**Figure 5 Analyzed upper air map from 00Z (800 PM EDT) July 28, 2004**

During July, there were numerous 90° days recorded across much of North Carolina, except in the mountains and along the beaches. The cities that recorded the most 90° days were over the interior sections of the state. Fayetteville topped the list of days with temperatures of 90° or more during July with 21. Raleigh recorded 15 days. The number of 90° days decreased rapidly with the increase in elevation to the west. Hickory and Mount Airy in the Foothills (elevations of 800 to 1200 feet) totaled only 7 and 5 days respectively. The mountain communities (elevations 2000 feet and above) recorded none. Even on the hottest days during July 2004, Asheville (elevation 2100 feet)

reached only the upper 80s. Boone (elevation 3300 feet) only reached around 80 degrees. Along the coast, New Bern and Wilmington recorded about one third of the 90° day totals than that of the cities farther inland. The cooler temperatures near the shore are primarily due to the proximity of the cooler ocean waters.

The number of days with 90° temperatures decreased noticeably in the moister environment over the state during last two weeks of the month. For example, Greensboro recorded 11 90° days during July 2004, with only 3 of the 90° days occurring after July 15. Similarly, Raleigh recorded 15 90° days during the month, with only 3 of the 90°days occurring after July 15.

Figure 6 is a table of cities and the number of 90° days recorded during July 2004.

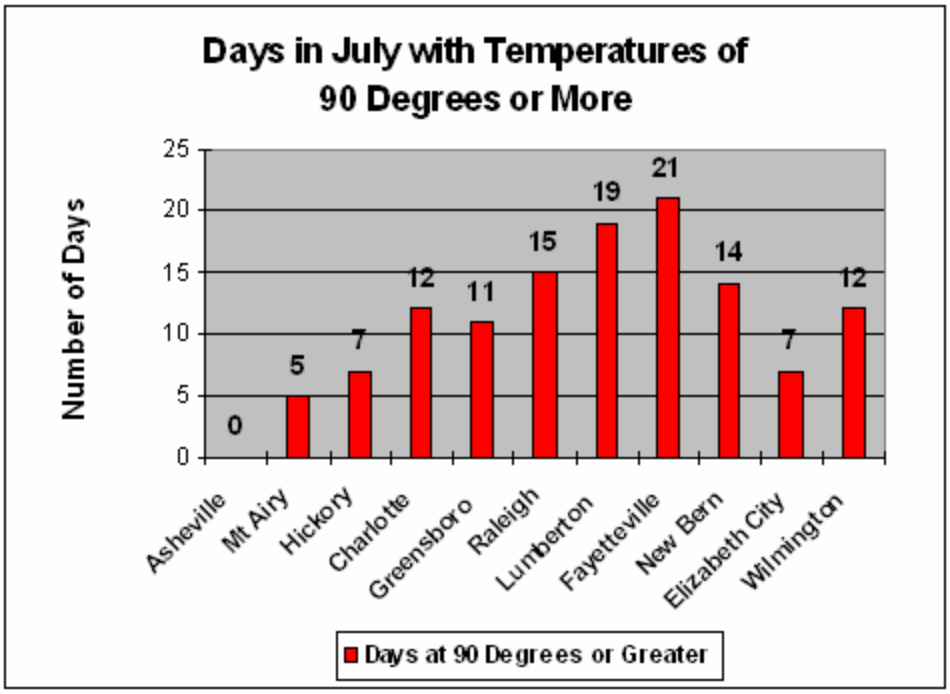


**Figure 6 Chart depicting the number of days with temperatures at or exceeding 90° at selected locations across North Carolina.**

## Precipitation

The wetter pattern over the last few weeks of July allowed monthly rainfall totals to recover to normal or above normal values after a dry start to the month. There were numerous stations that recorded rainfall amounts in excess of 7 inches including: Henderson (Vance County), 8.79 inches; Robbinsville (Graham County), 8.72 inches; Raleigh-Durham (Wake County), 8.16 inches (3.87 inches above normal); Greensboro (Guilford County), 7.14 inches (2.70 inches above normal); Graham (Alamance County), 7.80 inches; Roanoke Rapids (Halifax County), 7.71 inches; and Wilmington (New Hanover County) 7.14 inches.

However, not everyone benefited from the generous thunderstorm rains. The southern Coastal Plain and Coastal Area from Lumberton to Clinton, Goldsboro, Kenansville, Tarboro, and New Bern reported the driest region during July. The thunderstorm activity was less concentrated and more scattered in these areas. Several locations barely recorded over 2 inches for the entire month. The driest reports included: Lumberton (Robeson County), 2.67 inches of rain (2.94 inches below normal); Clinton (Sampson County), 2.51 inches; Mocksville (Davie County), 2.86 inches; Sanford (Lee County), 3.02 inches; Blewett Falls Dam (Richmond County), 2.47 inches; Fort Bragg (Cumberland County), 3.71 inches; New Bern (Craven County), 3.55 inches; and Cape Hatteras (Outer Banks Dare County), 4.47 inches (0.48 inches below normal).

Figure 7 depicts the rainfall totals for North Carolina for July 2004. The map is based on actual rainfall reports from National Weather Service Cooperative Observers and other official observing sites.

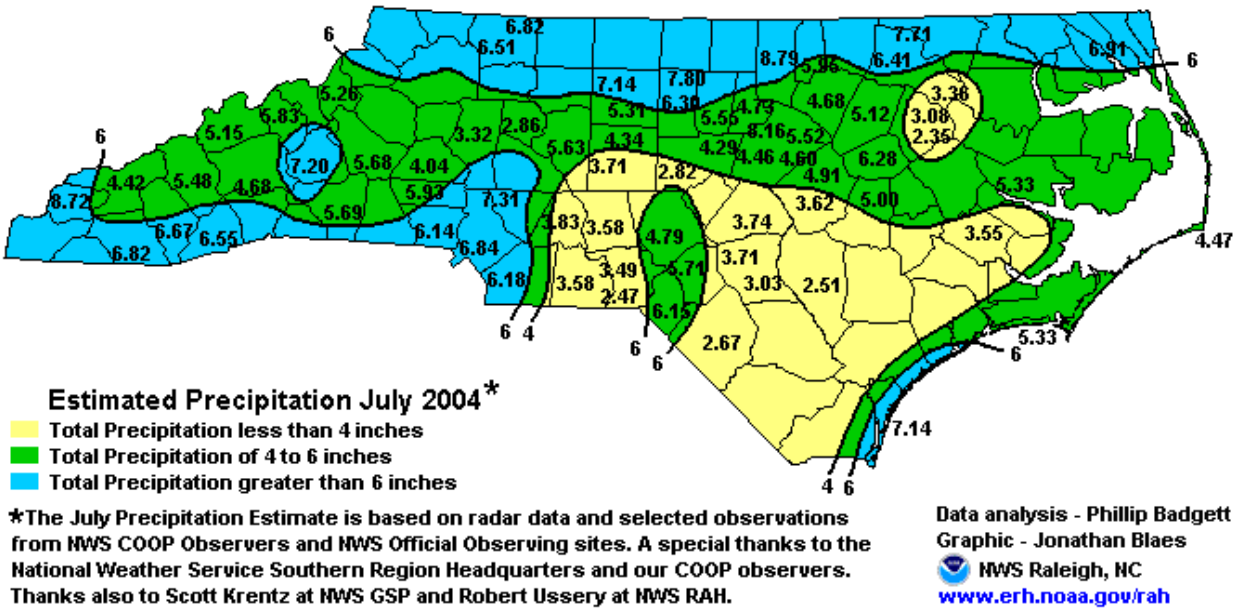


**Figure 7 Reported rainfall for selected National Weather Service sites for July 2004**

## Storm Scale Variability

The July rainfall amounts varied greatly within county boundaries and even within some towns themselves. A large variability of precipitation is typical across North Carolina during the summer season because of the scattered and localized nature of thunderstorms. A few county comparisons in July that showed a wide variability included: Raleigh-Durham Airport (Wake County), 8.16 inches, and Raleigh-NC State University (Wake), 4.60 inches; Roanoke Rapids (Halifax County), 7.71 inches, and Enfield (Halifax), 3.36 inches; Jordan Lake (Chatham County), 2.82 inches, and Jordan Lake (Chatham), 4.29 inches.

## Severe Weather and Tornado Reports in July 2004

There were several severe weather events that affected central North Carolina during July. One of which has been summarized and documented at the web site below.

July 14, 2004 severe thunderstorm event…
http://www2.ncsu.edu/eos/service/pams/meas/sco/research/nws/cases/20040714/

**Figure 8 Photograph of thunderstorms over Durham, Granville, and Person counties as viewed from North Raleigh on July 14, 2004.**

## Current, Semi-Annual and Annual Precipitation Trends

The string of 9 consecutive months of below normal monthly precipitation at Greensboro ended with July. However, that still did not wipe out the deficit for 2004. In the first 7 months of 2004, Greensboro totaled 18.94 inches of precipitation. This total was 6.90 inches below normal. Conversely, in the past 12 months (August 2003 through July 2004), Greensboro had seen a net precipitation surplus of 2.12 inches.

Similarly to Greensboro, Raleigh began the first five months of 2004 with below normal precipitation. The tide turned in June and July 2004, with two consecutive months of above normal precipitation. As a result, the semi-annual (January 2004 through July 2004) precipitation deficit at Raleigh dwindled away to only 0.41 of an inch. Meanwhile, the annual (August 2003 through July 2004) precipitation total reached a net precipitation surplus of 4.26 inches.

Semi-annual and annual precipitation trends at Raleigh and Greensboro are highlighted in figures 9 and Figure 10 respectively.

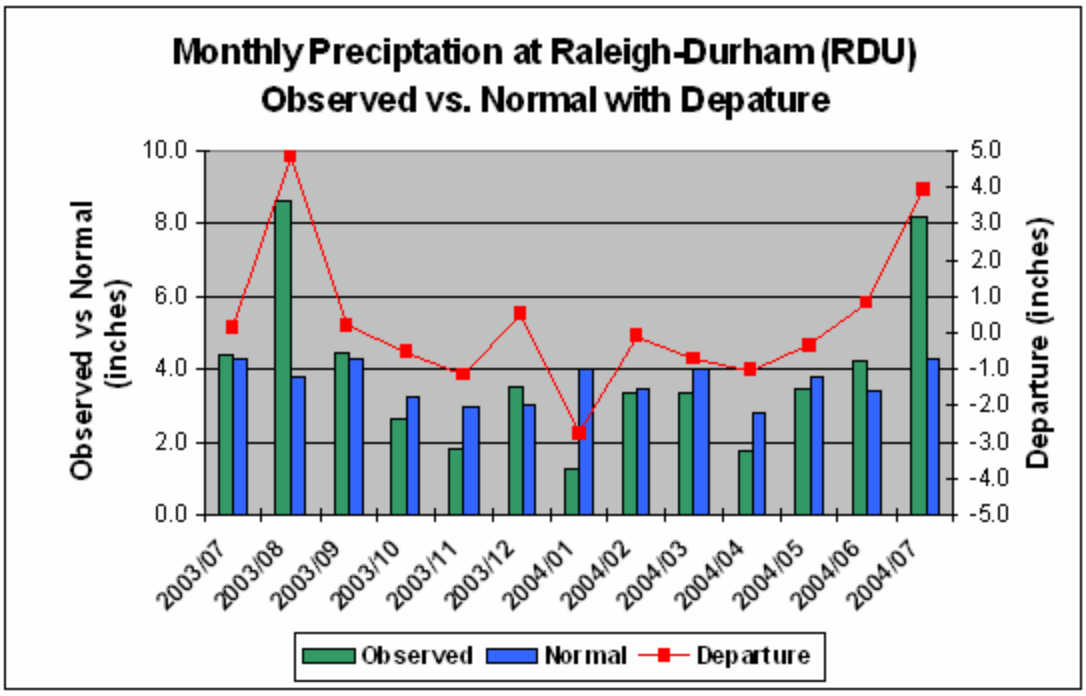


**Figure 9 Chart depicting the semi-annual and annual precipitation trends at Raleigh-Durham (RDU).**

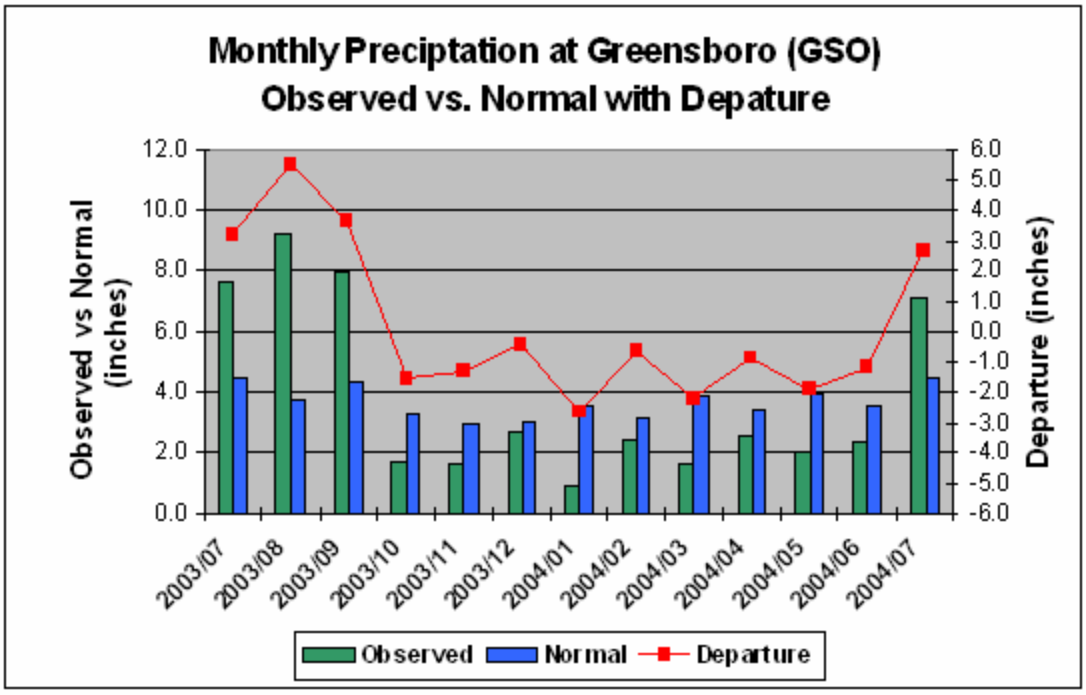


**Figure 10 Chart depicting the semi-annual and annual precipitation trends at Greensboro (GSO).**

The fairly large surpluses of rainfall across western and northern sections of the state eased short term drought concerns. As of July 31, 2004, there were no long-term drought or ground water shortages in North Carolina. Only parts of the Sandhills and extreme southern Piedmont had abnormally dry conditions as of late July 2004 as indicated by the U.S. Drought Monitor Map (Figure 12). The August of 2004 Precipitation Outlook from the Climate Prediction Center suggests an increased likelihood of above normal precipitation across the state. Semi-annual rainfall deficits are expected to lessen resulting in an elimination of the
abnormally dry areas that remained across southern North Carolina.

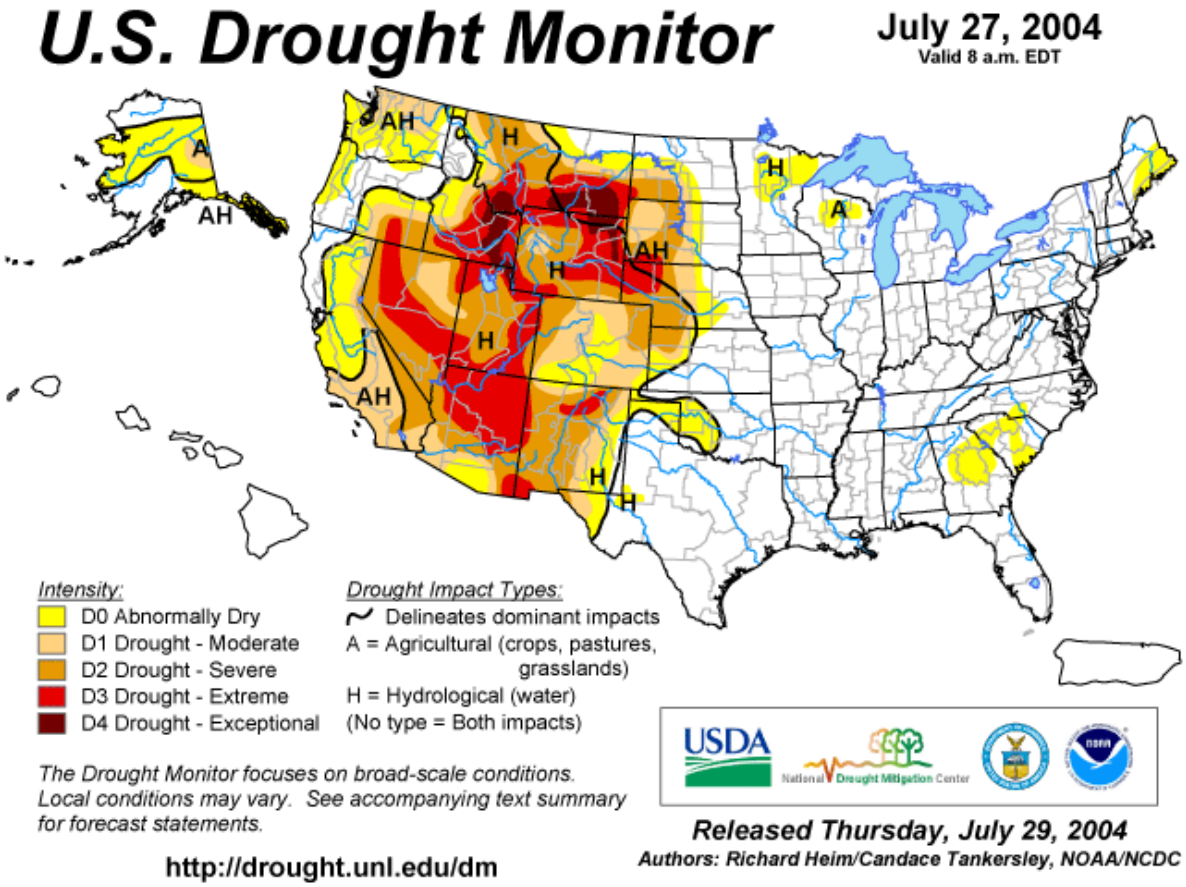


**Figure 11 U.S. Drought Monitor depicts abnormally dry conditions only across portions of the North Carolina Sandhills and southern Piedmont in late July 2004.**

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